

TOUCH PANEL

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority under 35 U.S.C. §119 to Japanese Patent Application No. 2006-328419, filed Dec. 5, 2006, and which is hereby incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to a touch panel used as an input device and provided on the surface of displays and the like of various electronic devices.

BACKGROUND OF THE INVENTION

[0003] In recent years, there has been widespread application of electronic devices equipped with touch panels in the display screens thereof. However, extraneous light and reflections cause glare on the surface of these touch panels and affect the visibility of the display. To avoid this, the touch panel film may undergo surface processing known as antiglare processing, whereby the surface of the touch panel is made coarser to scatter light. A method for making the film surface coarser is to coat the film surface with a UV curing resin in which fine particles, known as filler, are dispersed, and then to cure the resin to form a roughness of several microns.

[0004] As described for example in Japanese Unexamined Patent Application Publication No. 2004-351744, which is incorporated herein by reference in its entirety, a touch panel 2 using this type of touch panel film 1 is configured as shown in FIG. 4. The touch panel 2 is equipped with a touch panel substrate 4, which is a transparent insulative substrate, provided on the front surface of an electronic device liquid crystal display 3. A transparent electrode 7b of ITO (indium-tin oxide) film or the like is provided in a predetermined pattern on the surface of the touch panel substrate 4. Then the touch panel film 1 is attached so as to cover the touch panel substrate 4.

[0005] The touch panel film 1 is formed from a film substrate 5 of PET (polyethylene terephthalate) or the like, and on the surface facing the rear surface of the touch panel substrate 4, a transparent electrode 7a of ITO film or the like is provided via an anchor layer 6 at a predetermined spacing of gap g with the transparent electrode 7b of the touch panel substrate 4. Moreover, on the front surface of the film substrate 5 of the touch panel film 1, a filler 8 having a particle size of approximately several microns is affixed with a UV curing resin 9.

[0006] However, with the higher resolution of liquid crystal displays in recent years, although the above-described type of antiglare processing with particles of several microns in size is able to suppress reflections and other glare, because light rays from the liquid crystal material have a fine pitch, the filler and roughness thereof cause the light from the liquid crystal to reflect diffusely, creating glare and causing color separation in the liquid crystal pixels, thereby noticeably degrading the visibility of the display.

[0007] Thus, Japanese Publication No. 2004-351744 discloses a touch panel to which antiglare processing is carried out using a filler of fine particles having an average primary particle size of 100 nm or less, forming a ten-point average roughness Rz of at least 100 nm but less than 500 nm.

[0008] The prior art disclosed in the Japanese Publication No. 2004-351744 corresponds to a liquid crystal display having a high resolution known as eXtended Graphics Array (XGA) resolution and a pixel pitch of approximately 123 dpi, but does not provide sufficient effect in suppressing glare and the like for the higher resolution liquid crystal displays of today such as Wide XGA (WXGA) and Super XGA (SXGA) displays having pixel pitches of approximately 0.2/mm.

SUMMARY OF THE INVENTION

[0009] The present invention was devised in consideration of the above-described prior art, and it is an object of the present invention to provide a touch panel having a simple configuration wherein no degradation of visibility occurs even when used in a high resolution display.

[0010] The present invention is directed to a touch panel comprising a transparent film substrate of PET or the like, and a transparent electrode film of ITO film or the like formed on one surface thereof; wherein an arithmetic particle roughness Ra of 0.1 μm to 0.01 μm is formed on the film substrate surface opposite that on which the transparent electrode is formed, and the Ra is formed to be between $1/2000^{\text{th}}$ to $1/4000^{\text{th}}$ of the pixel pitch of the display to be attached.

[0011] Moreover, the touch panel further comprises a coating layer provided on another surface of the film substrate, and a filler of fine particles distributed and aligned nearly uniformly in a layer within resin in the coating layer; wherein the filler has an average particle size of 0.1 μm to 0.01 μm . The coating layer is formed to have an Ra of 0.1 μm to 0.01 μm , of $1/2000^{\text{th}}$ to $1/4000^{\text{th}}$ of the pixel pitch of the display to be attached.

[0012] The touch panel according to the present invention may be produced using a mold formed to have an Ra of 0.1 μm to 0.01 μm that is pressed against the other surface of the film substrate on the side opposite that on which the transparent electrode is formed, thereby forming an Ra of 0.1 μm to 0.01 μm on the other surface of the film substrate and forming an Ra of $1/2000^{\text{th}}$ to $1/4000^{\text{th}}$ of the pixel pitch of the display to be attached.

[0013] Additionally, an anchor layer may be disposed between one surface of the film substrate and the transparent electrode. A filler of fine particles is distributed and aligned nearly uniformly in a layer within resin in the anchor layer; the filler having an average particle size of 0.1 μm to 0.01 μm , thereby forming an Ra of 0.1 μm to 0.01 μm on the anchor layer, and forming an Ra of $1/2000^{\text{th}}$ to $1/4000^{\text{th}}$ of the pixel pitch of the display to be attached.

[0014] The present invention is capable of providing an inexpensive touch panel having good visibility, without any reflection from extraneous light, and without occurrence of display glare and color separation, even when used in a high resolution display.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The invention will become more readily apparent from the Detailed Description of the Invention, which proceeds with reference to the drawings, in which:

[0016] FIG. 1 is a schematic cross section drawing of a touch panel consistent with the principles of the present invention.

[0017] FIG. 2 is a schematic cross section drawing of another touch panel consistent with the principles of the present invention.